Scheduling Overview

Pre-Scheduling

- Project Database Defining
- Long Term Planning
- FDF Data Ingest
- BAP Defining

(Guy Swope)

Initial Scheduling

- Schedule BAPs
- Manually Schedule Activities
- Incorporating ASTER Resource Profiles
- TDRSS Contact Scheduling

(David Hyde)

Final Scheduling

- Schedule Deviations
- Conflict Resolution
- Load Uplink Scheduling

(Tony Cetuk)

Daily Scheduling

- DAS Creation
- ATC Load Generation
- Ground Script Generation

Late Changes

- Schedule Late Change
- Update ATC Load

(Real-Time Only)

(Neil Clabough)

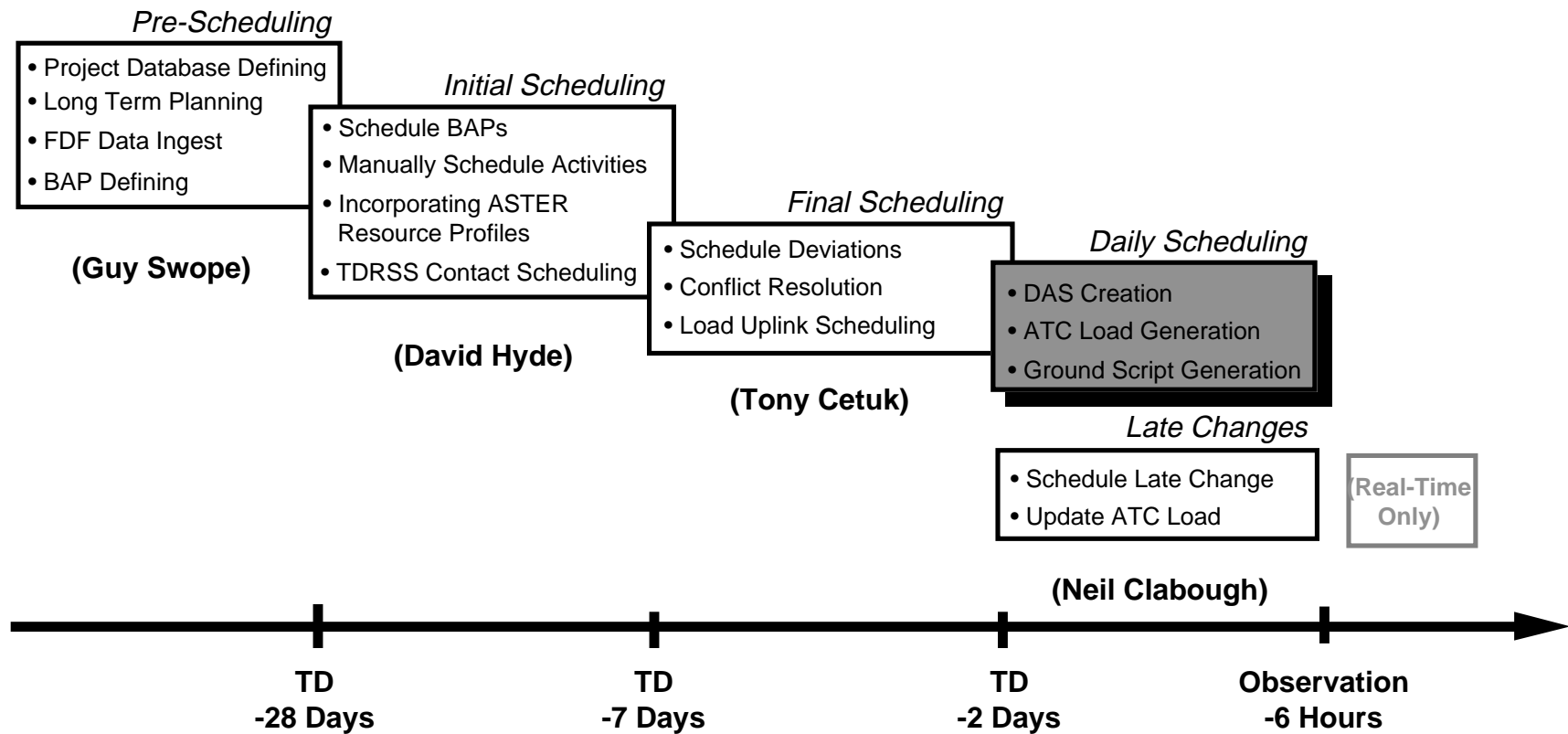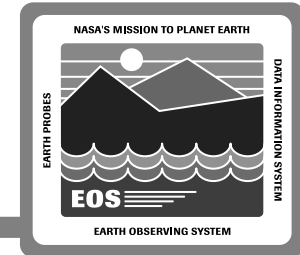| TD -28 Days	TD -7 Days	TD -2 Days	Observation -6 Hours

Daily Scheduling Overview

Functions of Daily Scheduling

- **Release of Detailed Activity Schedule for a target day**

- **Generation of ATC Load based on Detailed Activity Schedule for a target day**

- **Generation of Ground Script based on Detailed Activity Schedule for a target day**

Detailed Activity Schedule Release Description

Boundaries for DAS are set using Daily Plan Tool

Release of DAS accomplished using Daily Plan Tool

- Creates a conflict-free 24-hour Detailed Activity Schedule two days before target day
  - Activities frozen to disallow further scheduling unless in form of a late change
  - Boundaries defined to avoid "splitting" activities
- Removes activities violating hard constraints from DAS
- Allows activities violating soft constraints to remain in DAS, pending approval

Daily Plan Tool
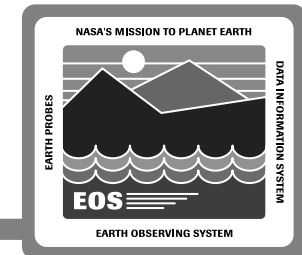
Detailed Activity Schedule Design
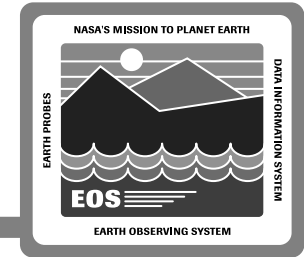
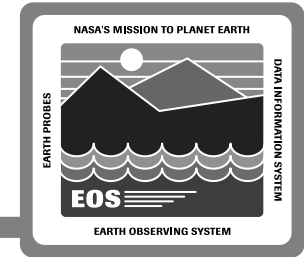See following page.

Detailed Activity Schedule Release Scenario

Using Daily Plan Tool, EOC planner/scheduler

- Selects "DAS and ATC Load" plans
- Specifies target day
- Initiates generation

Boundaries established in Mission Schedule to avoid splitting activities

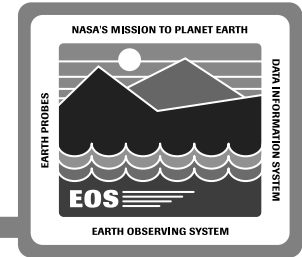Activities violating hard constraints removed from Mission Schedule and can be rescheduled at a later time

Protections on activities are set to disallow further scheduling unless in form of a late change

The DAS is

- Created
- Distributed to EOC, IST, ASTER ICC, and SDPS
- Made available for ATC Load generation
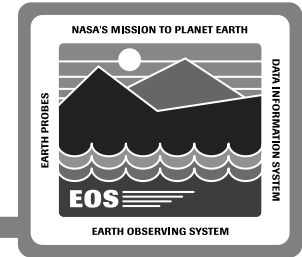
ATC Load Generation Description

Generate an ATC Load based on contents of ATC Schedule

- **The DAS provides starting time and list of activity ids**
- **The ATC Load includes**
  - **All the commands scheduled to be executed during target day**
  - **All the commands for scheduled activities starting on target day and ending on next target day**
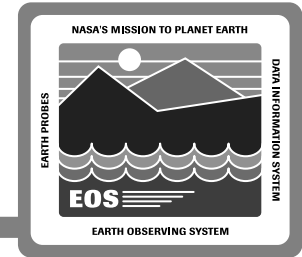
Spacecraft Object Model

See following page.

Schedule Object Model (cont.)

See following page.

ATC Load Generation Scenario

The commands for the ATC Load selected from ATC Schedule

The commands organized into a load content

- Commands mapped into ATC buffer
    - Each command assigned a buffer location
    - Overlapping commands from previous load are over written
- The commands divided into more than one load if necessary
- An uplink window is determined for load
- Benign state commands are added to load

The commands undergo a final constraint check as an assurance measure

ATC Load Generation Scenario (cont.)

The commands converted into binary through use of command database

The uplink load is constructed

- Check sum computed
- Load initiate command added
- CCSDS packet headers appended
- Load split into 4K sections if necessary

The load report for the ATC Load is produced

The uplink of ATC Load automatically scheduled and added to Ground Script

Ground Script Generation Description

The Ground Script is based on Ground Schedule

- The DAS provides starting time and a list of activity ids

- The Ground Script includes:

  - All commands scheduled for execution during target day

  - All commands scheduled for execution during last 3 hours of previous target day

Expected State Tables produced for use during Real-time Activity phase

Schedule Object Model

See following page.

Ground Script Generation Scenario

The commands to be included in Ground Script selected from Ground Schedule

Spacecraft commands converted:

- into ground script comments if they are not scheduled during a spacecraft contact

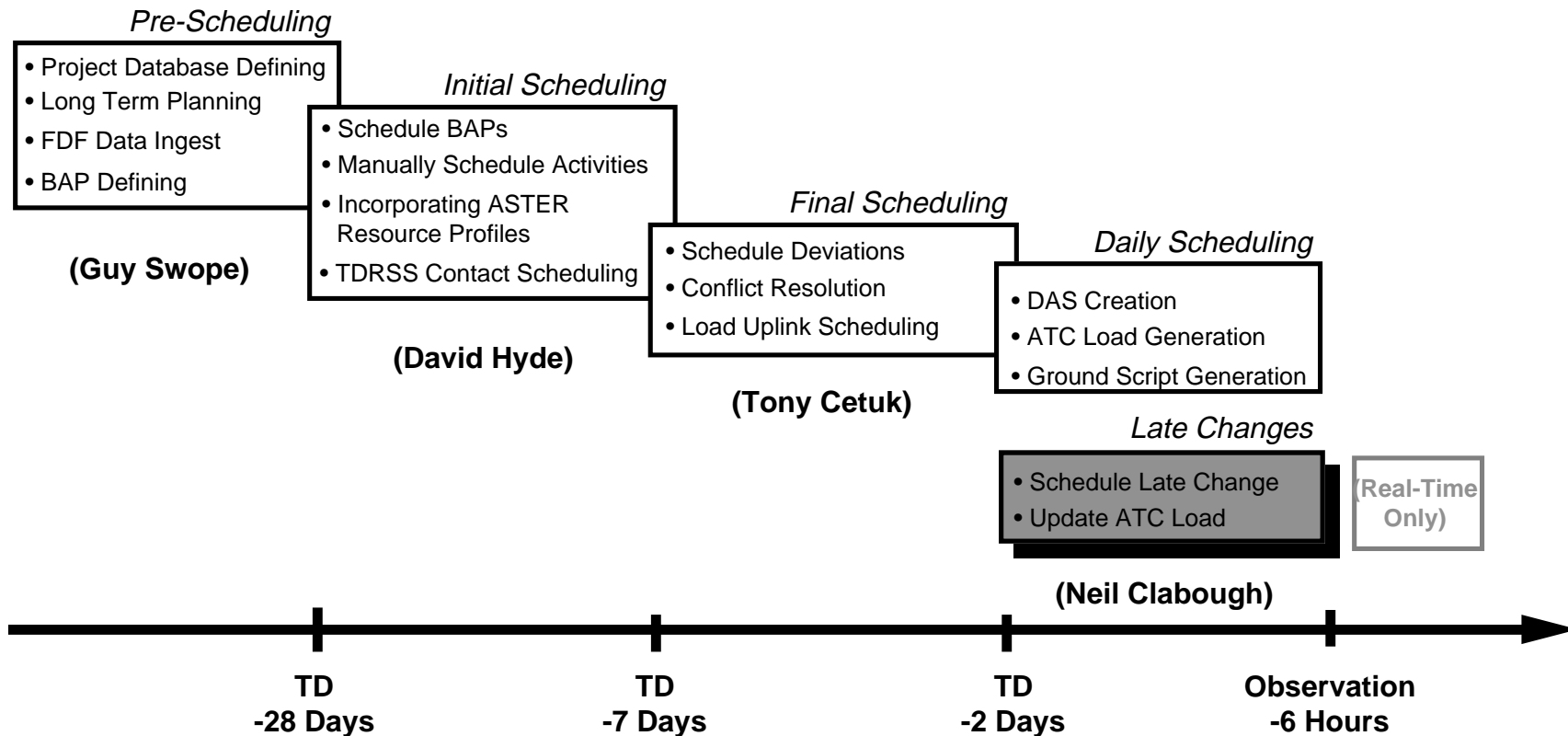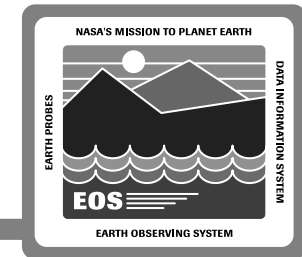- into real-time verification commands if they are scheduled during a spacecraft contact

A final constraint check performed on ground script commands

Ground Script is created

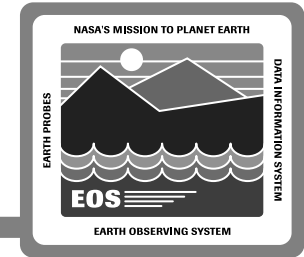Expected State Tables generated

Integrated Load Report generated for target day

Scheduling Overview

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Daily Scheduling

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- Ground Script Generation

Late Changes

- Schedule Late Change
- Update ATC Load

(Real-Time Only)

(Neil Clabough)

| TD -28 Days | TD -7 Days | TD -2 Days | Observation -6 Hours |

Late Changes Overview

Late changes are any schedule changes to a target day that occur

- after DAS is released (nominally 48 hours before target day)
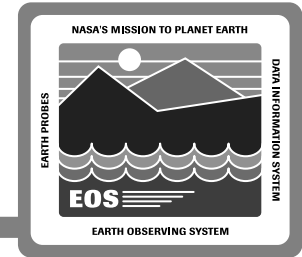- up to 6 hours before event affected by change

Examples of late changes are:

- A last minute rescheduling of a TDRSS contact
- Targets of Opportunity (TOO's)

Late changes result in generation of:

- Detailed Activity Schedule update
- ATC Load update
- Ground Script update

Scheduling Late Changes

Scheduling of late changes must

- have a high priority
- be subject to approval

Scheduling of late changes and TOO's follow normal scheduling sequence

Updated DAS must be generated and released no later than 6 hours before first scheduled late change

- Provides time to produce ATC Load and Ground Script updates
- Provides time to uplink updated ATC Load

EOC planner/scheduler uses Daily Plan Tool to generate and release updated DAS

Daily Plan Tool
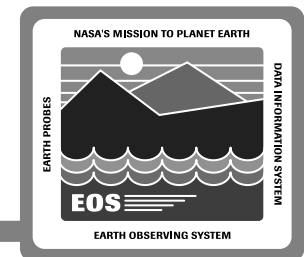
Schedule Late Change Scenario

An approved late change request is received by the FOT

The late change is scheduled into Mission Plan

Using Daily Plan Tool, the EOC planner/scheduler:

- Selects "DAS and ATC Load" plans
- Specifies target day
- Initiates generation and release of update

An updated version of the DAS is:

- Created with changed activities identified
- Distributed to EOC, IST, ASTER ICC, and SDPS
- Made available for ATC Load update generation

ATC Load Update Description

An ATC Load update generated when a DAS update released

Processing of a DAS update produces:

- Either a replacement ATC Load or an ATC Patch Load
- Either a replacement Ground Script or a patch Ground Script

Replacement ATC Loads generated if original ATC Load has not been uplinked

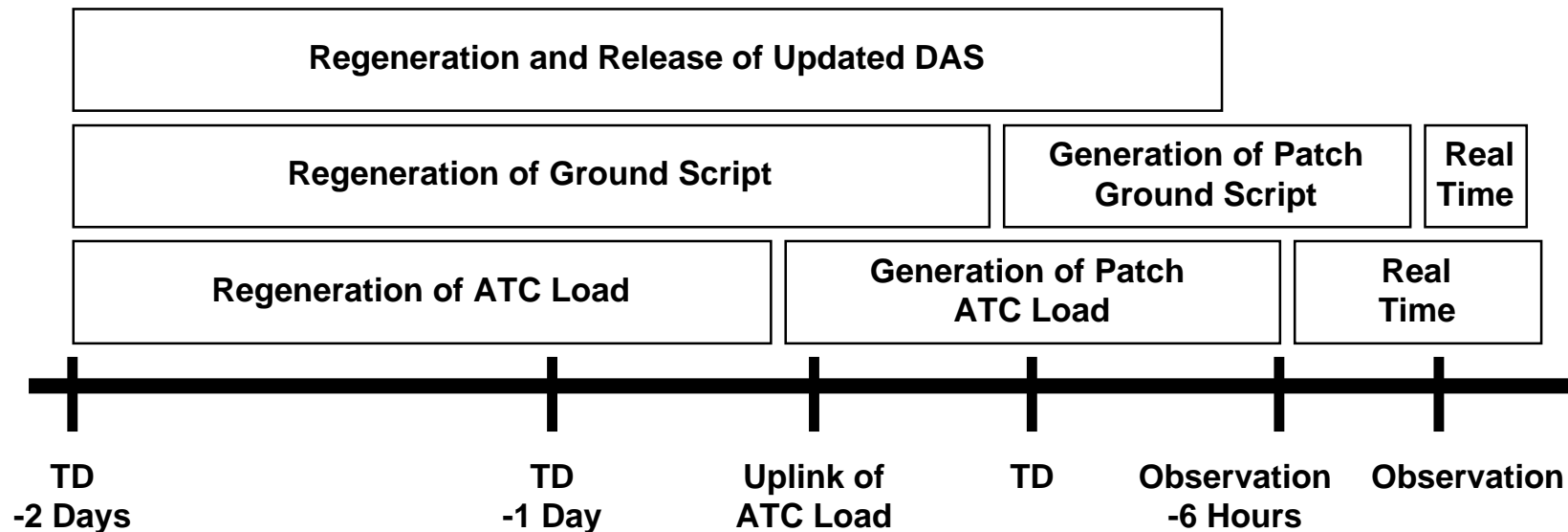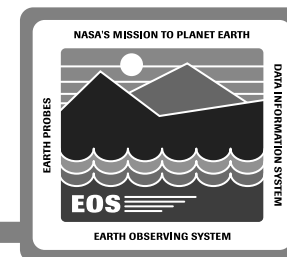ATC Patch Loads generated if original ATC Load has been uplinked

- An ATC Patch Load contains all commands from first change to the end of target day

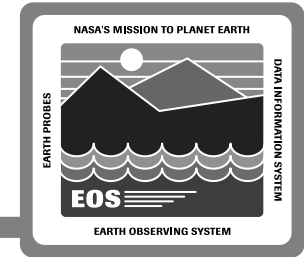Replacement Ground Scripts generated if original Ground Script has not started executing

Patch Ground Scripts generated if original Ground Script has started executing

- A patch Ground Script contains all commands from 3 hours before first change to end of target day

Scheduling Timeline

Regeneration and Release of Updated DAS

Regeneration of Ground Script

Generation of Patch Ground Script

Real Time

Regeneration of ATC Load

Generation of Patch ATC Load

Real Time

TD -2 Days | TD -1 Day | Uplink of ATC Load | TD | Observation -6 Hours | Observation

ATC Load Regeneration Scenario

Pre-Conditions

- **An approved late change has been received 18 hours before start of target day**
- **An updated version of DAS has been generated and released**

The system automatically determines that original ATC Load has not been uplinked
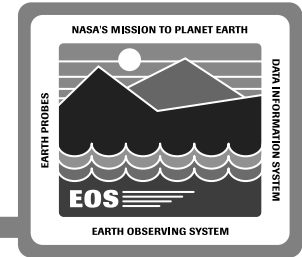
Generation of replacement ATC Load follows scenario described for normal ATC Load generation

The system automatically determines that original Ground Script has not started executing

Generation of replacement Ground Script follows scenario described for normal Ground Script generation
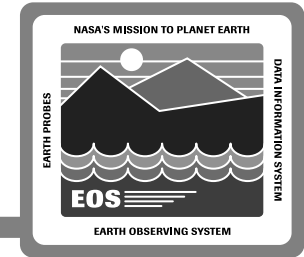
Schedule Object Model

See following page.

ATC Patch Load Generation Scenario

Pre-Conditions

- **An approved late change has been received 3 hours before start of target day**

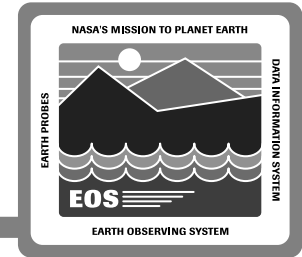- **An updated version of the DAS has been generated and released**

The system automatically determines that original ATC Load has been uplinked

The commands selected from ATC Schedule

- **The DAS provides time of first change**

- **The ATC Patch Load includes:**

  - **All commands from scheduled time of first change to end of target day**

  - **All commands for scheduled activities that start in current target day and end in next target day**

ATC Patch Load Generation Scenario (cont.)

The ATC Patch Load's commands are mapped over commands in ATC buffer that are scheduled to execute between start of first change to end of original ATC Load

ATC Patch Load generation follows normal scenario for ATC Load generation after assignment of buffer locations to commands

The system automatically determines that original Ground Script has not started executing

The commands are selected from Ground Schedule

- The DAS provides time of first change
- The patch Ground Script includes all commands from 3 hours before scheduled time of first change to end of target day

Patch Ground Script generation follows normal scenario for generation of a Ground Script after selection of commands